

THE HEAVY RAINFALL OF SEPTEMBER 2, 1922, AT WASHINGTON, D. C.

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[Weather Bureau, Washington, September, 1922.]

Rain which began at 1:55 a. m., September 2, 1922, was not continuously heavy, but heavy downpours were interspersed at three different points in the duration of the storm. The first began at 3:45 a. m. and continued for 15 minutes, with a total fall of 0.22 inch; at 4:10 a. m. 0.10 inch fell in five minutes; then the rain slackened until 5:25 a. m., when the very heavy fall of the storm began, continuing until about 7:15 a. m., the total fall in this time being 3.49 inches. A third and last excessive fall occurred at 8:30 a. m., lasting about 15 minutes. Rain ceased at 10:25 a. m.

A noteworthy characteristic of the storm was the absence of local surface wind movement. The direction of the wind before and during the first part of the storm was southeast, with occasional backing to the northeast. During the heavy downpours it was in an easterly quarter and the force was very light; the total wind movement from midnight of September 1 to 6 a. m. of September 2 was but 30 miles, or an average of 5 miles per hour. During the succeeding six hours the wind freshened to an average of 7 miles per hour.

It is generally held that the quantity of rain that falls in very heavy local storms is due to the importation of moist air from outside of the immediate center of heavy precipitation. The cause of the periods of excessive rain interspersed throughout the course of the storm can not be determined from surface conditions. The dewpoint and relative humidity at the 8 p. m. observation of September 1 were 65° and 79 per cent, respectively, and at 8 a. m. September 2, 70° and 100 per cent, respectively; it may then be assumed that the moisture content of the air was high. The barometric conditions were rather stable, with a gradient for southeast to south winds. It is possible, however, that there may have been a local depression in the pressure field over the District of Columbia, as indicated by the loop in the isobar of 30.10 inches on the morning map of September 2. Otherwise it is difficult to account for the northeast air currents that were registered. Since surface relief can not be invoked to account for the heavy downpours, there remains the inference that more or less vagrant currents of cooler air were probably brought in by northeast winds. These latter, being cooler than the southeast winds, would under-run them and thus cause them to be cooled below the dewpoint.

It is interesting to consider for a moment the tremendous weight of water precipitated over the District of Columbia in this storm. The average of 25 stations as given in the table below is 4.23 inches. East of the Anacostia River there was a small area having a total fall greater than 5 inches. In the neighborhood of the Weather Bureau building there was another and larger area of 5 inches, but in general the fall was between 4 and 5 inches. Taking it as 4 inches, and remembering that 4 inches of rain correspond to 452 tons (2,000 pounds) to the acre, the total water precipitated on a square mile of the city of Washington would be $452 \times 640 = 289,200$ short tons, and this number multiplied by, say, 40 as roughly approximating the area affected by the storm in square miles, gives a grand total of 11½ million short tons of water that had to be disposed of on the date in question.

The table below gives the rainfall as measured at 25 different points within the District of Columbia.

TABLE 1.—Rainfall as measured at 25 different points within the District of Columbia.¹

Station No.	Rainfall.	Station No.	Rainfall.
	Inches.		Inches.
1.	5.63	15.	4.92
2.	5.00	16.	3.69
3.	3.68	17.	3.37
4.	3.75	18.	5.00
5.	3.88	19.	2.40
6.	4.38	20.	3.55
7.	4.62	21.	4.42
8.	3.95	22.	4.10
9.	3.87	A.	3.65
10.	4.58	B.	4.19
11.	4.00	Weather Bureau.	5.16
12.	5.00		
13.	4.80	Mean.	4.23
14.	3.75		

¹ Courtesy J. B. Gordon, sanitary engineer, District of Columbia.

Note added September 15.—Since writing the above there has come to my attention an automatic record of an intense rainfall at Pulaski, Va. Through the courtesy of the General Chemical Co. of New York, Mr. E. C. Knobel, in charge plant extension division, a photostat copy of the tipping-bucket-gauge record of the intense rainfall of July 21, 1922, at Pulaski has been received.

The intensity of the rain in this case was great from the very beginning of the storm, and the rain ceased almost as suddenly as it began. The total in one hour was, by tipping bucket, 3.60 inches, and by stick measurement, 3.31 inches.

Pulaski is in the extreme southwestern hilly country of Virginia and is situated on Peak Creek, a tributary of New River. This creek flows in a general east-northeast by west-southwest direction in a valley between Tract Mountain on the northwest and Draper Mountain on the southeast, the latter distant about 2 miles from the village of Pulaski and about 800 feet higher.

Pulaski on the morning of July 21 was in a region of weak pressure gradient and light winds; at the beginning of the rain and for several hours previous the wind had been light northeast; at 8:06 p. m. it shifted to west and 10 minutes later to southeast, from which direction it continued until the end of the rain. The force of the wind was greatest during the early part of the rain, but it did not exceed 10 miles per hour at any time.

In 1894 the late Prof. C. Abbe computed the equivalent amount of aqueous vapor in the atmosphere if condensed as rain under certain assumed surface dewpoint temperatures in a column of air of various altitudes. The computation showed that the total amount of moisture in a column of saturated air extending from sea level up to 30,000 feet (5.7 miles) with a surface dewpoint of 80° F. would amount to 2.8 inches; at dewpoint 70° it would be 2.1 inches. The dewpoint at Washington, D. C., at the time of the heavy downpour must have been at least 70°, and since the rainfall was more than double that amount, it might be inferred that the air column over Washington was completely renewed during the prevalence of the rainstorm. The same conditions would apply to Pulaski, Va.